CLAIMS

We Claim:

1. A method of combusting a liquid primary fuel comprising the steps of:

establishing a zone of combustion, spaced from a fuel nozzle, and defined by a flame of ignited hydrogen,

dispersing a liquid primary fuel through said fuel nozzle into the zone of combustion in a partially vaporized state and partially atomized state; and

burning the vaporized liquid primary fuel and the atomized liquid primary fuel entering said zone of combustion.

2. The method of claim 1 wherein the zone of combustion zone is defined by a generally conical surface symmetric about a longitudinal axis.

3. The method of claim 1 wherein the hydrogen combustion zone is established by the steps of:

providing a pressurized source of hydrogen through a conduit having a discharge opening adjacent said zone of combustion,

igniting the hydrogen discharged through said discharge opening to produce a hydrogen flame; and

rotating the hydrogen flame about a longitudinal axis of the zone of combustion.

4. The method of claim 3 further comprising the steps of providing a second conduit for delivering hydrogen through a second discharge opening adjacent the zone of combustion, igniting the hydrogen discharged through said second discharge opening to produce a second hydrogen flame, and rotating said second hydrogen flame about the longitudinal axis.

5. The method of claim 3, further comprising the step of setting a speed of the rotating hydrogen flame to optimize a combustion efficiency of the primary fuel.

6. The method of claim 1 where the source of hydrogen flowing through the conduit comprises a predetermined mixture of hydrogen and oxygen.

7. The method of claim 6 wherein that predetermined mixture is a molar ratio of hydrogen to oxygen having a value of 2:1.

8. The method of claim 7 wherein the source of hydrogen and oxygen flowing through the conduit is obtained from hydrolysis of water.

9. The method of claim 3 wherein said discharge opening is radially spaced from said longitudinal axis and angled toward the central axis of rotation.

10. The method of claim 3 wherein a speed of the rotating hydrogen flame in a circumferential direction is not less than a forward flame velocity of the ignited hydrogen.

11. The method of claim 1 wherein said step of dispersing said liquid primary fuel further comprises flowing a pressurized source of liquid primary fuel through a conduit of a rotating shaft and including a discharge end having an atomizing nozzle to discharge the liquid primary fuel into the zone of combustion.

12. The method of claim 1 where said primary fuel is selected from the group comprising processed and unprocessed vegetable oils, by-product oils from agricultural products processing, liquid and liquefied petroleum fuels, and liquid and liquefied animal fats.

13. The method of claim 3 where the step of providing pressurized hydrogen from the hydrogen source further includes the steps of

generating a constant rate of hydrogen and oxygen gases from the electrolysis of water, and

transferring the hydrogen and oxygen gases into a fixed-volume staging chamber such that the hydrogen and oxygen gases are continuously exposed to an inlet opening of conduit.

14. The method of claim 1 further including a step of injecting a controlled rate of an additive selected from steam and water into the zone of combustion to control the formation of oxides of nitrogen.

15. The method of claim 14 where the injection of said additive is accomplished by pre-mixing the water at a controlled rate with the liquid primary fuel.

16. A burner for combusting a liquid primary fuel and hydrogen comprising:

a rotating shaft with a proximal end and a distal end connected to a burner tip,

a pair of circular hydrogen transport channels formed inside the rotating shaft, each channel having an inlet portion with an inlet port communicating exterior to the shaft for receiving the hydrogen from a source, and an axial portion extending from said inlet portion longitudinally to a burner tip flange,

a primary fuel conduit formed inside the shaft, said conduit having an inlet port for receiving the liquid primary fuel and an axial portion running perpendicular to the longitudinal axis of the shaft for transporting the primary fuel from the inlet port to the burner tip flange,

a coolant chamber formed around the shaft closest to the distal end for containing a circulating coolant fluid,

a hydrogen chamber containing a pressurized hydrogen gas source in fluid communication with said hydrogen transport channels; and

a primary fuel chamber containing a pressurized primary liquid fuel in fluid communication with said primary fuel conduit.

17. The burner of claim 16 where the axial portion of the hydrogen transport tubes extends away from the longitudinal axis of the shaft at an angle between 10 and 30 degrees relative to the longitudinal axis.

18. The burner claim 16 wherein the burner tip is comprised of:

a solid circular flange having a proximal face attached the end of the shaft, a distal face adjacent to a combustion zone, a hole for passing the liquid primary fuel from the primary fuel conduit and a pair of holes for passing the hydrogen from the hydrogen transport tubes,

a pair of hydrogen discharge tubes extending from the hydrogen holes and projecting away from the distal face of the flange in an axial direction with respect to said shaft, and then in a direction which intersects the longitudinal axis of said shaft; and

a liquid dispersing nozzle disposed at the primary fuel hole for discharging the primary fuel into the combustion zone.

19. The burner tip of claim 18 where said hydrogen discharge tubes include a first axial portion having a length between 0.5 and 3 inches, an inwardly directed portion having a length between 0.5 and 3 inches, and wherein said axial direction is defined by an angle between 22 and 60 degrees relative to the axial centerline of said axial portion of said hydrogen transport tubes.

20. The burner of claim 16 further including an electrolytic cell for generating hydrogen and oxygen gases connected to the hydrogen chamber, where the rate of hydrogen being fed to the burner is controlled by varying the surface area of the electrolytic plates in the cell and current input to the electrolytic cell.

21. The burner of claim 16 further including a fourth chamber around the shaft for staging a secondary material to be injected into a combustion zone, with the shaft including additional transport tubes located therein for transporting the secondary material to the burner tip.